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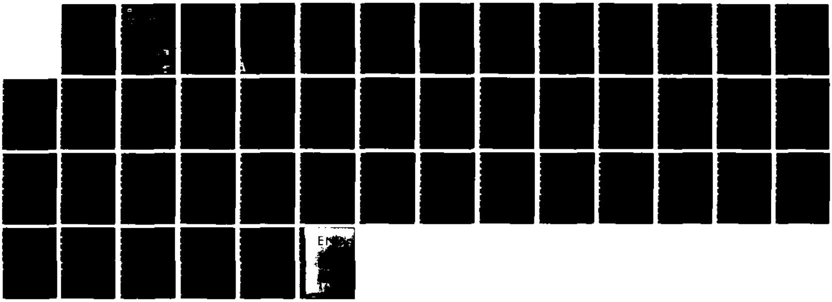

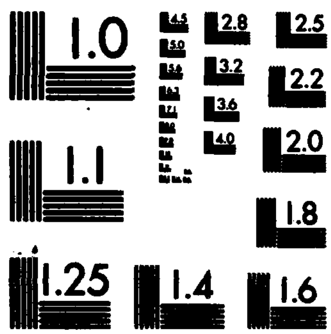
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US Army Corps
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AFTER ACTION REPORT
LOCK AND DAM NO. 1
REHABILITATION
Minneapolis, Minnesota

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) AFTER ACTION REPORT LOCK AND DAM NO. 1 REHABILITATION, MINNEAPOLIS, MINNESOTA		5. TYPE OF REPORT & PERIOD COVERED Final
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s)		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Engineer District, St. Paul 1135 USPO & Custom House St. Paul, MN 55101		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS		12. REPORT DATE September, 1983
		13. NUMBER OF PAGES 42 p.
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

LOCKS (WATERWAYS)
INLAND NAVIGATION
MISSISSIPPI RIVER
CONSTRUCTION

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Lock and Dam No. 1 is located at Mississippi River mile 847.6 above the mouth of the Ohio River and between the cities of St. Paul and Minneapolis, Minnesota. The lock and dam has been plagued by numerous problems, most of which were related to its overall structural stability, the poorly functioning hydraulic filling and emptying system, and aging operating machinery. The high potential for these problems to develop into a major failure, requiring closure of river traffic to Minneapolis, prompted the Corps of Engineers to initiate a comprehensive rehabilitation program in the early 1970's. → over

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The details of the project requirements were the result of thorough investigative work: historic research, interviews with personnel, economic analysis, engineering analysis and extensive condition surveys. Rehabilitation was broken into stages to insure minimal interruption to river traffic. The bulk of construction was performed in two winter periods. To complete on time, blasting was chosen as the medium for concrete removal.

Completion of Lock and Dam no. 1 on June 30, 1983 was the culmination of over 20 years of research, planning, engineering, and construction. Rehabilitation had minimal affect on the river's environmental and commercial aspects and was performed at one-fourth the cost of reconstruction.
The fact sheets compiled in this report were written by personnel who were involved in the different aspects of rehabilitation, and highlight some of the significant aspects and considerations.

LOCKS AND DAM NO 1 REHABILITATION

AFTER ACTION REPORT

Department of the Army
St. Paul District, Corps of Engineers
St. Paul, Minnesota
September, 1983

LOCK AND DAM NO. 1
AFTER ACTION REPORT

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LOCK AND DAM NO. 1
AFTER ACTION REPORT

INTRODUCTION

Lock and Dam No. 1 is located at Mississippi River mile 847.6 above the mouth of the Ohio River and between the cities of St. Paul and Minneapolis, Minnesota. The original structure was completed and placed in operation in 1917 and included a 152-foot length hydroplant adjacent to the left bank, a 574-foot crest length, Ambursen type dam surmounted by 2-foot high automatic release flashboards and eight sluiceways, and an 80 by 360-foot navigation lock. In 1915 and 1916, during construction of the powerhouse and dam, a flood wiped out a large portion of the unfinished dam and an existing railroad bridge. In 1929, the lock failed, cutting off all barge traffic to Minneapolis. To insure against a future interruption to barge traffic, it was decided to build twin locks each 56 by 400 feet at this site. The first lock (riverward lock) was completed in 1930 and the second lock (landward lock) was placed into operation in 1932.

Since the completion of the structure in the 1930's, Lock and Dam No. 1 was plagued by numerous problems, most of which were related to its overall structural stability, the poorly functioning hydraulic filling and emptying system and aging operating machinery. The high potential for these problems to develop into a major failure, requiring closure of river traffic to Minneapolis, prompted the Corps of Engineers to initiate a comprehensive rehabilitation program in the early 1970's.

From the onset, the goal of the rehabilitation was to achieve a "good as new" lock and dam facility at a reasonable and justifiable cost. The details of the project requirements were the result of thorough investigative work: historic research, interviews with personnel (Design and Operations) having knowledge of the structure, economic analysis, engineering analysis and extensive condition surveys. The Phase A Report identified and evaluated four possible rehabilitation schemes. Full rehabilitation of the Land Lock, modification of the River Lock's operating machinery and stabilization of the dam was chosen as the plan.

Rehabilitation was broken into stages to insure minimal interruption to river traffic. The bulk of construction was performed in two winter periods. To complete on time, blasting was chosen as the medium for concrete removal.

Hydraulic model studies were performed by WES to determine solutions to the problems with the filling and emptying systems. These studies resulted in modifications which were performed under Stage 1. The intake and discharge manifolds were reconstructed. Stoney valves for filling and emptying were removed and reverse tainter valves were installed. Conduits were lowered and the shapes changed from round to square steel lined. Post tensioned anchors through the I-wall and

the land wall were installed to insure lock stability. Additional filling ports, trenches in the lock floor, wall resurfacing and mooring bitts were also installed.

The central control station, service building, utility building, dam entrance building, lock wall control houses, access bridges, river wall improvements, and miscellaneous demolition and restoration were all part of Stage 2 construction. It also included external utility systems for electrical (power, control, and lighting), fire alarm, communication, stage recording, compressed air, fire protection, potable water and sanitary sewer.

Stage 3 construction connected water and sanitary systems to the City of Minneapolis.

The dam was rehabilitated under Stage 4. Post-tensioned stability anchors were installed in the dam apron and the downstream guide wall, deteriorated concrete on the dam apron was removed and new concrete placed, and backfill was placed behind the downstream guide wall.

Stage 5A, 5B, and 5C construction contracts were used to improve the site condition. Roadways, bluff protection, fencing, landscaping and drainage facilities were installed.

Rehabilitation of Lock and Dam No. 1 was a joint effort on the part of the Corps. Interaction of Engineering, Planning, Construction the Division Office, O.C.E., and W.E.S. contributed to the success achieved in the rehabilitation project.

Completion of Lock and Dam No. 1 on June 30, 1983, was the culmination of over 20 years of research, planning, engineering and construction. Rehabilitation had minimal affect on the river's environmental and commercial aspects and was performed at one-fourth the cost of reconstruction.

The fact sheets compiled in this report were written by personnel who were intimately involved in the different aspects of rehabilitation of Lock and Dam No. 1. The fact sheets, which make up the body of this report, highlight some of the significant aspects and considerations which surfaced during the project.

ITEM

Staged Construction.

SITUATION

A few months in advance of advertising, it became clear that the design documents would not be complete in time for a fall 1979 advertising. However, rather than postpone advertising, which would have required delaying construction a full year, a decision was made to use staged construction.

DISCUSSION

Even before this decision, we were, in a sense, using staged construction. Construction scheduling identified installation of the land wall stability anchors as a potential bottleneck. Therefore, this work was contracted to run concurrently with the 1978-1979 winter dewatering. Other minor construction contracts were issued for miter gate strengthening and installation of river lock relidf valves. A separate sanitary sewer and water contract had also been anticipated.

Fabricated steel items, operating machinery, steel sheet piling and a lock inclosure were procured through individual contracts. These are covered under the item, "Supply Contracts".

Except for the minor contracts mentioned, we had not really intended on using staged construction. It was only when the design schedule slipped that staged construction was instigated.

Stage 1, Hydraulic Improvements
Stage 2, Buildings
Stage 3, Sanitary Sewer and Water
Stage 4, Dam Apron and Lower Guidewall
Stage 5A, Safety Walls
Stage 5B, Access Road
Stage 5C, Security Fencing

Stages 5A, 5B, and 5C were originally scheduled as one contract. However, difficulty in finalizing the design details prompted the division into three small contracts.

ADVANTAGES

The foremost advantage is the earlier construction start.

Contractor expertise can be better utilized. Al Johnson Construction was good at mass concrete, demolition, cofferdams, etc. Mortenson Construction excels in building construction, etc.

DISADVANTAGE

The interfaces between stages must be thoroughly understood before issuing the initial contract, requiring more engineering experience and expertise and more cooperation between diciplines. Changes in concepts during preparation of contract documents may require costly modifications to previously issued contracts. Or, to avoid modifications, less desirable preliminary decisions may become "locked in".

On site coordination and interfacing between contractors must be covered in the specifications, but it is not possible to specifically cover all potential situations; what is a reasonable amount of delay to expect, who has priority in different situations, etc.

The overall length of construction may be longer for staged construction.

RECOMMENDATIONS

Stage construction should be anticipated for all large complex projects. Even if the work is eventually awarded as a single contract, the exercise is beneficial in organizing the project and understanding the interrelationship of its various components. If design delays threaten to delay the construction start, the option to go to staged construction is available. Also, the exercise will reveal the design components that are most sensitive to the contract organization. These items can then be given additional attention early in the design.

ITEM

Supply Contracts

SITUATION

Sheet piling, fabricated metals, and operating machinery were identified early on as long lead time items. Since the general construction contractor would need them relatively early in the construction schedule, it was necessary to procure these items by supply contract.

DISCUSSION

All supply contracts were administered through the Design Branch. Design Branch personnel made all intermediate inspections, negotiated changes and evaluated the final product. The Construction Branch became involved somewhat at the final acceptance, when the finished product was delivered to the site.

Some tolerances exceeding contract specifications were accepted. In these cases, the relaxation of tolerances were not considered important for the overall quality. Non-acceptance would have precluded timely delivery. These differences in tolerances and claims of design inadequacy were used by the main construction contractor in support of modification requests, consequently upsetting the relationship between Design Branch and Construction Branch.

In the case of the operating machinery, the supplier was allowed to bring it on site before full scale testing was conducted. The supplier wanted to do field tests and adjustments after installation. The operating equipment did not perform as intended and the supplier was unable to make acceptable adjustments. It was difficult and time consuming to track the problems and determine who was responsible: supplier, contractor or designer. This also upset the relationship between Design Branch and Construction Branch.

The ultimate conclusion was favorable. The procurement by supply contracts was a major reason that the 1979 - 1980 winter construction was possible and lock opening occurred on schedule.

ADVANTAGES

Supply contracts are an acceptable way to obtain long lead time items, when schedules would prevent timely procurement by the contractor.

Control of technical components by Design Branch probably gives better assurance of contract conformance.

DISADVANTAGES

Supply contracts provide the contractor with a way to avoid responsibility - pass the buck.

If the supplier fails to meet delivery, costly modifications with the contractor due to schedule changes could result.

More Design Branch - Construction Branch conflicts.

RECOMMENDATIONS

Supply contracts should be used only when absolutely required by the construction schedule. If posible, the construction schedule should be modified to avoid using supply contracts.

If supply contracts are used, it would be best to procure the product before advertising the construction contract. The product could then be displayed for inspection by prospective bidders.

A Design Branch/Construction Branch consensus concerning supply contract acceptance should be reached and maintained throughout the contract.

Suppliers should not be allowed to field test equipment. Field adjustments should be kept minor in nature.

ITEM

Operations/Engineering Coordination During Design and Construction.

SITUATION

Operations personnel know the problems associated with the lock, especially in operating. Design for the rehabilitation was performed by Engineering personnel.

DISCUSSION

Early in the design process before and during the study of alternatives, Operations furnished lists of problem areas and items needed. Additional information was furnished during detatiled design for reports, plans and specifications, on areas needed for different activities, siting, interaction of operating people and visitors, details of the many mechanical-electrical systems, operations during high water and many other items requiring attention. Meetings were also held between operators and designers to discuss operation procedures.

Coordination continued throughout construction involving Operation, Design and Construction personnel. Input was provided, during site visits by designers. Materials and color selections were also discussed.

ADVANTAGES

Operating people know about many of the problems and their operating procedures. They will also be working there for a long time; therefore, it only makes sense that they should have as much input as possible during the design.

DISADVANTAGES

Operating people could recommend costly items. Designers may have to question cost effectiveness of the item. In a few instances Operating people coordinated directly with Construction people and created some confusion. Designers sometimes used suggestions from operating people and the result was later criticized by them.

CONCLUSIONS

The advantages of coordinating the design and construction of a rehabilitation Project far outweigh the disadvantages.

RECOMMENDATIONS

During design and construction of a rehabilitation project, have designers and operating personnel coordinate as much as possible. Use a combination of formal coordination plus a lot of informal discussion making sure roles for all involved are clear.

Clearly define the scope of work that is allowable under the rehabilitation program. Funding can then be separated between Construction General and Operation and Maintenance from the beginning of the project.

ITEM

Engineering/Construction Coordination During Design and Construction.

SITUATION

The rehabilitation project was designed and constructed in stages with supply contracts for some mechanical, electrical, and structural components. The project stages and supply contracts were highly interrelated. With design delays and the splitting up of some stages, the time between became very short.

DISCUSSION

Due to the tight schedules, interrelationship between stages, complexity of some details, and the resulting modifications, fast and efficient coordination between Engineering and Construction was a necessity. Steps taken to fill this need were:

1. Documents were prepared and meetings held in which the Designers explained the reasoning behind construction details.

2. Constructibility reviews were held, some including partial layouts in the field. Operations personnel attended regularly.

3. Engineering had at least one person in the field to expedite coordination of shop drawing review and other Construction Engineering. (See separate Fact Sheet).

4. When major problems arose or questions regarding the design needed to be addressed, Design Engineering personnel were called upon. At times, Design personnel were overloaded, trying to balance Design and Construction Engineering duties on other projects which had high priorities. Therefore, unless need was critical, response to some items was sometimes slow. On many problems, especially those considered critical, such as cofferdam seepage and concrete cracking, Engineering, Construction and the contractors cooperated to solve them.

5. The status of revisions to contracts was coordinated in both directions, Design people keeping Construction people up to date about up coming revisions and Construction people informing Design people which upcoming revisions would be most critical for schedule completion.

6. Because of the technical nature of the blasting and because inspectors were unfamiliar with inspection procedure, Design assumed responsibility for training inspectors and monitoring work.

ADVANTAGES

We took advantage of people in Engineering to help Construction. Younger engineers and other people gained some valuable experience.

DISADVANTAGES

Schedules and/or work on other projects were adversely affected.

CONCLUSIONS

Even with the compressed schedule, the process went surprisingly well. The Rehabilitation Project was a good chance for many people to gain valuable experience.

RECOMMENDATIONS

Encourage designers to work with Construction as much as possible during construction of projects which they designed in order to get a better feel for their concerns, in other words to make the design-construction process more of a true team effort. Additional developmental assignments of designers to construction projects would also be useful to promote more of a team feeling.

ITEM

Assignment of a Design Engineer Full Time to the Project Site.

SITUATION

Due to the compressed construction schedule and the project complexity it was decided a Design Branch Representative would be needed at the site to review contractor submittals and act as a consultant to the Construction Branch Personnel.

DISCUSSION

The Design Branch representative duties included:

a. Maintained records pertinent to Desing Branch and brief other Design personnel who had only periodic involvement in the project.

b. Prepared daily logs, memorandums and took photographs. This information was accurate and concise and proved invaluable during contract negotiations with the contractor.

c. Made design decisions and involved and informed supervisors when necessary.

d. Participated in the daily correspondance among the Construction Branch, Design Branch and contractor personnel.

e. Conducted briefings and tours for Design Branch personnel.

RECOMMENDATIONS

The assignment of a Design representative to the project site proved very successful. It is recommended that this approach be considered where expediting of design interaction and interpretation of complex work is necessary on a continued basis.

ITEM

Staffing

SITUATION

Throughout the design/construction phase of the Lock and Dam No. 1 Rehabilitation, it became apparent that there was a insufficient number of mechanical and electrical engineers available in the St. Paul District. During the design it was necessary to work many hours of overtime in order to review the A-E firms work. Supply contracts ran simultaneously with the construction contract, and were administrated by the Design Branch. During construction, these disciplines were required to perform as inspectors on the site, while trying to carry on other Design projects back at the office.

RECOMMENDATIONS

Proper staffing should be anticipated prior to undertaking a project the size of Lock and Dam No. 1 Rehabilitation. It should be assumed that the Construction Branch will not have mechanical and electrical engineers on their staff, and this inspection and administrative work will have to be accomplished by the Design Branch.

ITEM

Architectural Design

SITUATION

The A/E firm retained for this project was responsible for all design, including the architectural concept design of the central control station, the service building and other features.

In the opinion of the District, the A/E was unable to achieve the desired aesthetic characteristics in their concept design. Therefore, the concept design was modified by the District and returned to the A/E for completion of the detailed design.

DISCUSSION

The design process became bogged down during the architectural concept design stage. Although the firm's architects were fully competent professionals and their concepts were functionally adequate, the concepts lacked the aesthetic punch required by this highly visible site.

RECOMMENDATION

Consideration should be given to the architectural impact of each project. On large projects, highly visible to the public, special arrangements should be undertaken to achieve good aesthetics.

Examples:

1. The A/E firm could be required to hire a architect subcontractor, approved by the District.

2. A separate contract could be used for the architectural concept design.

3. The concept design could be done in-house

4. A more detailed scope of work with many review points could be used. The scope should be tailored to the ability of the architect.

ITEM

Visitor and Operational Use of Facilities.

SITUATION

Because Corps of Engineers projects are water related, they also tend to be on very desirable pieces of property. Add to this the publics interest in large mechanically operating machinery and you realize that the Corps sites have a lot of appeal. We also had the feeling that Lock and Dam No. 1 was one of the best of these sites in the District and required that we deal with what we felt could be a superior visitor experience. A meaningful experience, however, means more than a overlook from which 50 people can look down into the Lock and did not necessarily follow along with providing efficent areas for operating the installation.

The development of the design solution determined that because of the differences in these two functions (visitation and operation) a separation was the best answer. A very restricted access to the site required that visitors and operational employees use the same access, however, with separation beginning at a turn around area from which the employees enter an operational area for parking and from which visitors proceed on foot to the service building. From there over to the river wall (an area of little maintenance activity) the visitor is elevated 20 feet above the top of the lock walls. This arrangement separates the two functions, allows the visitor to penetrate the site, and maintains an access that can be used to distribute utilities and can be used when access over the gates is not available.

RECOMMENDATIONS

Beyond the fact that our regulations require visitation to be an integral part of the project, the benefits that the Corps gets from making some kind of effort far out weighs the costs. We found that even on a congested site operations and visitor functions can be provided, without adversely affecting the quality of either area. Operational counts have indicated a daily use of 500-1000 visitors during the summer, indicating that the public has found the site to be something with which they enjoy interacting.

ITEM

Utility and Access Bridge

SITUATION

The hydraulic and utility lines which operated the original lock were conveyed between the three lock walls through trenches in the lock floor. As part of the rehabilitation project, an analysis was conducted to determine the most effective means of accomplishing this function for the rehabilitated lock.

CONSIDERATIONS

The existing means of conveying hydraulic and utility lines in the lock floor was considered very undesirable from an operations and maintenance point of view. Leaks and breaks were difficult to locate and even more difficult to repair. Exposure to the river elements hastened deterioration.

Access between the locks walls was also an operations problem. Waiting for miter gates to close or walking the length of the lock to use the opposite gates was inefficient during normal operation and potentially serious during an emergency. In addition, a hazardous sling arrangement was required during the 1965 and 1969 floods to gain access to the intermediate and river walls.

Thus an access bridge was considered necessary for efficiency, safety and cost effectiveness. Once this decision was reached, some minor modifications were made to permit access to the bridge by visitors while separating, as required, the operations and visitor functions.

RECOMMENDATIONS

The cost of an access bridge to convey operations personnel, hydraulic lines, and utilities across the lock chambers was as cost effective as conveyance by other means when the entire design life of the project is analyzed. The additional benefits derived from giving visitors a more meaningful tour of Locks and Dam No. 1 makes the bridge a significant and successful aspect of the rehabilitation project.

ITEM

Use of Historical Data.

SITUATION

There were records going back to before 1920 on the existing locks, dam, and powerhouse. Some examples of records are, reports, plans and specs, construction histories, construction photos, and special studies for original construction and maintenance projects.

DISCUSSION

By taking time to assemble records and go through them the many people involved during design and construction were better able to understand the existing structure and its problems and were able to piece together specific details which affected the design or helped to explain problems during construction. Some examples where understanding was enhanced by use of past records are foundation conditions especially below lock walls and dam, details of construction joints and joints between monoliths, reinforcing locations, and other embedded items, seepage problem areas, details of portions of an older lock left in place, details of past failures or near failures, details of past cofferdams, construction details of dam and reasoning behind its design.

In some cases the information gained could have been better used. If there would have been more time, additional information could have been located that would have helped during design and construction.

ADVANTAGES

Especially for a rehabilitation project, the more you can learn about the existing conditions the better off you will be during design and construction.

DISADVANGAGES

If past records aren't accurate you could be misled.

RECOMMENDATIONS

Especially for a rehabilitation project, it pays to gather all available data, index it if necessary, and spend as much time as possible learning from the data. It seemed like everytime we went through the past data or when a new problem arose we learned more.

ITEM

Vortices at Culvert Intakes.

SITUATION

The redesign of the intake manifold for the landward lock has greatly reduced the vortex problem in the upstream approach area. However, for the infrequent period of time (an average of 4.3 percent of the days in the navigation season) when flows are greater than about 25,000 cfs, vortice formation has occurred over the intake manifold during the filling operation. The W.E.S. Technical Report HL-79-21 did state that insignificant vortex action would exist. However, the upstream approach area differs from that modeled at W.E.S. The sheet pile cofferdam cells extending upstream from the riverward wall were left in place to prevent boats from being drawn into the upstream approach area of the dam. During high river flows, the changed condition in the upstream approach area results in the formation of a large eddy which appears to contribute to the formation of the observed vortex action. The changed condition was not modeled since the plan was changed after completion of the model tests.

Due to the relocation of the intake manifolds upstream from the miter gate recesses, debris accumulation in the recesses due to the vortices is no longer a hinderance to the lockage operation. When the vortices are present, a safety problem does exist for small pleasure craft.

RECOMMENDATIONS

After a field investigation in April 1982 to observe the problem, the following options for correcting the situation were identified:

1. Remove the sheet pile cells - (as stated previously, this option was discarded due to the fact that the presence of the cells resolves a more serious safety problem).

2. Install a cover for the landward lock intermediate wall miter gate bulkhead recess - (this is inexpensive but it is thought that it will have only a minor effect).

3. Develop a modified valve schedule - (this would increase filling time).

4. Implement operational procedures to prevent small craft from entering the upstream approach area during the filling operation - (the only way to guarantee this would be to install a physical barrier, which would not be practical).

The 10 May 1982 NCSED-GH Memorandum for the Record, subject: "Operational Safety at Lock and Dam No. 1" discusses the details of the field investigation.

Additional tests will be performed to determine the effect that the vortices have on small craft and commercial traffic, and to test options for the elimination of the vortices.

ITEM

Lock Culvert Air Vents for Controlled Admission of Air.

SITUATION

The 12-inch air vents, located downstream of the emptying and filling valves, were installed as recommended in W.E.S. Technical Report HL-79-21 to prevent the potential for structural damage in the filling and emptying valve areas due to cavitation.

At the time of the initial filling operation, the following conditions existed:

1. The knife gate control valves, which control the admission of air into the venting system, were not installed.

2. A wood cover was bolted on top of the air vent for the landward lock intermediate wall filling valve.

3. A sheet of plywood was lying on top of the wood cover.

4. The old intake ports were still in place.

5. The lock culvert modifications were not complete; however, the culvert had been lowered so there was no resident air in the system below the filling valves.

During the initial filling operation, a large volume of air entered the filling system. (The source of entry is uncertain. It may have been through vortex action at the intakes or the filling valve bulkhead slots.) In the first portion of the filling operation, this air was trapped in the downstream portion of the conduit. As the filling operation proceeded, this air moved upstream inside the lock culvert until it reached the air vent, where it exited with considerable force. The sheet of plywood which was located above the vent was thrown a considerable distance into the air (above the top of the flag pole) by the jet of air and water which was emitted from the vent. Luckily no one was injured.

RECOMMENDATION

As explained above, the incident occurred while modifications were partially complete. It illustrates the need for exercising extreme caution in operating a lock under conditions for which its performance characteristics are unknown. If air vents are used in a lock filling and emptying system, the knife gate control valves should be completely installed prior to lock operation.

The knife gate control valves have been temporarily adjusted. Final testing of the prototype filling operation is planned to determine the optimum valve schedule(s). The final adjustments for the knife gate control valves will be determined at that time.

ITEM

Lock Filling Time.

SITUATION

The 4-minute valve schedule recommended in the W.E.S. TR HL-79-21 resulted in a filling time of 10.2 minutes with an acceptable degree of turbulence in the lock chamber during model tests. It was expected that, due to differences in friction losses, the prototype lock would fill or empty about 10 percent faster than the model lock. In addition, turbulence in the lock chamber was expected to be satisfactory and safe for large tows as well as small craft with a 4-minute valve time. In the prototype, the 4-minute valve schedule required modification due to unacceptable turbulence observed in the lock chamber. A modified valve schedule in use at the present time has resulted in filling times of about 12 minutes for barge traffic and about 15 minutes for pleasure craft. The resulting filling times are a considerable improvement over what existed prior to the rehabilitation of the lock but the reduction in filling time is not as large as expected in the model study. It is realized that the criteria for determination of what constitutes an acceptable degree of turbulence in the lock chamber involves a subjective decision so that some differences may occur between the results observed in the model versus the prototype.

RECOMMENDATION

Field investigations of the prototype filling operation are planned so that a final determination of the optimum valve schedule(s) can be accomplished. The determination would involve input from the individuals who operate the system and are familiar with its peculiarities.

ITEM

Lock Chamber Floor Trenches.

SITUATION

The depth of the trenches in the lock floor is not as deep as recommended in the model study.

DISCUSSION

Due to irregularities in the elevation of the lock chamber floor, it was decided to remove enough concrete to provide a minimum trench depth of 12 inches. During trench construction, the underlying concrete was damaged. To insure structural integrity, it was decided to add steel plate liners to the bottom of the trenches. After the liners were installed, the average trench depth was approximately 9.5 inches (it ranged from 7 to 11 inches). Because of the probability of causing more damage to the lock chamber floor, it was decided not to attempt the additional concrete removal required to produce a 12-inch trench depth.

The depth recommended in the W.E.S. model study report was 12 inches. The model was tested with no trenches, with trenches 1 foot deep, ar. with trenches 2 feet deep. The model with 1-foot deep trenches produced the least turbulence in the lock chamber during tests.

RECOMMENDATION

The problem encountered during construction was not foreseen although extensive efforts were made to coordinate model study investigations with others involved in the design. Whether or not the variation from the design depth in the trenches has a significant effect on turbulence in the lock chamber during filling is not known. Prior to initiating future physical model studies, careful consideration should be given to insure that all possible construction problems are addressed. In this case, being aware of a possible problem in attaining the recommended depth would have allowed the conditions to be model tested to determine if the trench depth reduction had a significant effect on the lock chamber turbulence during filling.

During the next dewatering, the floor trenches will be inspected.

ITEM

Discharge Manifold.

SITUATION

Due to time constraints in the construction schedule, the discharge manifolds were constructed using preformed sections. Some of the preformed sections are not aligned properly. The jutting edges create inefficient flow conditions in the manifolds and make the sections more susceptible to damage. The jutting edges were ground, and the joints patched in an attempt to provide a more smooth transition. When the lock was dewatered after one season of operation, most of the patched material was missing.

DISCUSSION

The misaligned sections have had little effect on the hydraulic efficiency of the emptying system since the time required for the lock emptying operation is very close to that predicted in the W.E.S. Technical Report HL-79-21. The discharge manifold has minimized turbulence in the downstream approach area. If further erosion of the concrete does not occur, the effects of the misalignment will be relatively minor.

RECOMMENDATION

The discharge manifolds will be monitored for possible deterioration of the concrete.

ITEM

Controlled Blasting

SITUATION

The rehabilitation of the locks and dam required the removal of over 14,000 cubic yards of concrete, most of which could be removed only during lock closure. Therefore, since cost/benefit analysis and political considerations supported the scenario of maintaining near normal lock operation, the majority of concrete needed to be removed during the normal winter closure period.

DISCUSSION

A cursory estimate suggested that two dewaterings would be sufficient if blasting were used. However, this estimate was based on unconfirmed production rates.

Blasting experts consulted suggested that a test program be undertaken to confirm the feasibility of blasting and to provide guidance in establishing design and damage control criteria. They confirmed the District's suspicion that the typical contractor would not have the expertise to develop a safe, reliable blasting program, particularily in the time allowed.

An extensive test blasting program conducted during the 1978/1979 investigative dewatering confirmed the feasibility of blasting and provided the data necessary for developing design and damage control criteria. The credentials of the program director included a Ph.D. in physics and extensive experience in blasting.

The results of the test program were used to prepare blasting documents, plans and specifications, for inclusion in the general construction contract. Blasting results, excluding those related to workmanship, were the responsibility of the Government.

The District retained the same blasting expert who managed the test program to prepare the design and to supervise inspection of the blasting related construction activities. Many changes were made during construction.

The results of the removal effort were in general exceptionally good. Unwanted effects occurred in a few instances, mostly due to unknown structural conditions; but in some instances, they were due to out of tolerance drilling or faulty wiring or attempt to achieve more precision than the contractor was able to give.

CONCLUSION

A state-of-the-art blasting program was developed and successfully used to accomplish concrete removal at Lock and Dam No. 1.

RECOMMENDATIONS

Preliminary evaluation. Review historical documents and field inspect site to accurately define existing conditions. Test foundation and concrete materials. Perform crack and dimension surveys. Locate all structures within a quarter mile of the site.

Test program. Except for complex projects and projects with tight construction schedules, the test program can be executed in the early stages of construction contract. The program need not be as elaborate as the one performed at Lock and Dam No. 1. However, it should be supervised by a blasting expert.

Construction Documents. Method specifications and detailed plans should be prepared by a blasting expert. If the test program is conducted in the initial stages of construction, the blasting plans must be reviewed and modified before starting production blasting.

Inspection and supervision. Inspectors trained in controlled blasting techniques should be used. The blasting expert should be available for consultation and for designing modifications and evaluating problems. Full documentation of all operations is a must.

REFERENCES

U.S. Army Corps of Engineers (1982), "Selected Concrete Removal by Controlled Surgical Blasting", Lock and Dam No. 1, Minneapolis, Minnesota.

ITEM

Cracking of concrete.

SITUATION

Deteriorated concrete was removed from a sample length of lock wall (two monoliths) and replaced with new concrete. The forms were stripped just prior to initial watering of the lock. As the wall began to dry after pool draw down, water retained in cracks, which were barely visible when dry, clearly showed a pattern throughout the concrete overlay. The cracks were typically four to five feet on center, both vertically and horizontally. Cores taken over cracks transverse to the lock wall, showed the cracks to be full depth. The cores showed good bond between new and old concrete. The cracking was probably the result of a volume change in the new concrete which was restrained by the existing concrete. Temperature more than drying shrinkage was assumed to be the source of initial volume change because the cracks probably occurred before excessive water evaporation was possible.

DISCUSSION

Prior to full-scale resurfacing, all aspects of the contractor's performance were reviewed, no major deficiencies were found.

One of the resident engineers was assigned sole responsibility for monitoring the concrete placement and quality. He assured that good construction practices were followed within the limits of the specifications. Efforts to have the ready mix concrete delivered at lower temperatures than required by the specifications failed.

The cracking problem was discussed with OCE, WES and other districts. No immediate solution to the problem was at hand but it was found to be a common occurrence.

For this project, it seemed apparent that cracking would occur. Therefore, we installed horizontal control joints at six foot on center. Vertical joints were not installed, because it was thought they would be more vulnerable to barge impact. The joints were effective in controlling cracks.

Attempts were also made to find an acceptable material for use on future project. One monolith was surfaced with a fly ash mix and one with a shrinkage compensating cement mix. In each case the same crack pattern was observed.

Horizontal surfaces overlayed with six inches of concrete also cracked on about the same spacing.

CONCLUSION

The cracks are tight and the concrete quality and durability characteristics are good. Therefore, the concrete can be expected to retain its integrity for the design life.

WES will be studying the cracking phenomenon with hopes of finding economical methods of eliminating cracks from overlay concrete.

RECOMMENDATIONS

Concrete mix specifications should be restrictive: Placing temperatures, aggregate size, cement quantities and w/c ratios. Fly ash mixes should be given consideration.

All projects should include test areas for testing new products and methods.

Specifications must be strictly enforced. All contractor operations must be closely monitored.

Control joints should considered where aesthetics are important.

ITEM

Fire Protection

SITUATION

Provide a means for Government personnel or professional firefighters to react to fires caused by recreational, navigational or commercial activities in the vicinity of the land lock chamber or top of land lock walls.

DISCUSSION

Traditionally any provisions for firefighting at navigation locks have been augmented systems using potable or service water. These systems were neither dedicated to or intended for fighting fires.

ADVANTAGES

The system will be available in the event of any fire that could endanger property or personnel. Recently the system was used to help subdue a navigational fire aboard a coal barge.

DISADVANTAGE

Additional maintenance for lock personnel, especially freeze protection during the winter months.

RECOMMENDATIONS

Provisions for fighting fires at navigation locks should not be limited to portable multi-purpose extinguishers but should consider as a minimum simple water based systems or even more complex foam-chemical based systems if the justification & degree of protection is warranted.

ITEM

Passive and Active Solar System.

SITUATION

Energy conservation has become increasingly important in the design of new or renovation projects. Active solar systems have been marketed for use in all parts of the country with some success in the results. The design decision we made was that while active solar systems were possibly more glamourous, it was the passive aspects of the building design that should be emphasized. Active systems were seen as still being in an early stage of their development and that any active effort should be directed towards the learning potential. We did use a relatively new technology incorporating freon as the heat transfer medium for the potable hot water system. The freon in this system reacts as a phase change material.

The passive systems that were incorporated for energy conservation included increasing or decreasing glass areas, installing night insulation over glazed areas, adding mass (water tubes) to the interior of the building to absorb energy and stabilize temperatures, and designing the south elevation so that window areas would be shaded in summer while allowing the sun to penetrate deep into the interior during the winter.

RECOMMENDATIONS

We found that passive solar energy design is simply good architectural design and should always be a part of the design process. We used an energy simulation computer program (BLAST) which helped but was tedious and time consuming. The buildings have not gone through a winter heating season under our control but we are expecting good results. We also experienced some hesitancy from the work force in using the night insulation and water tubes. The feasibility of active systems should be determined for specific areas during design development.

ITEM

Use of BLAST (Building Loads and System Thermodynamics) Program

SITUATION

Harza Engineering originally designed the HVAC for the buildings at Lock and Dam No. 1. Due to architectural changes and building use changes the systems had to be modified.

DISCUSSION

Two people from the Design Branch attended a class at the University of Wisconsin on the BLAST program and it was decided to try this program to redesign the HVAC at Lock and Dam No. 1. Previous to the Rehabilitation of Lock and Dam No. 1 the most elaborate system this office had designed had been unit heaters, or small forced air furnaces, and all calculations were done by hand using procedures from the ASHRAE handbook of fundamentals.

ADVANTAGES

Any changes to building or system is easily changed in program. Comparisons of different designs are easily analysed. Full year simulations can be performed to find yearly operating costs.

DISADVANTAGES

Complicated input for persons not very well experienced with the many types of systems used in large buildings. The BLAST program is more suited to very large systems and using it on the relatively small packaged system at the Lock was probably a waste of computer time when there are programmable calculator programs that will give just as good results.

RECOMMENDATIONS

This office will probably never be involved in a design of a large HVAC system elaborate enough to justify the use of the BLAST program, but using it was a good experience to see what it is capable of doing. Since using it at Lock and Dam No. 1 we have obtained many programmable calculator programs that will handle any future designs we may encounter.

ITEM

Use of Hydraulic Cylinders Permanently Under Water.

SITUATION

The Rehabilitation of Lock and Dam No. 1 included the use of hydraulic cylinder operators directly connected to the filling and emptying tainter valves. The cylinders on the filling valves are always under water. The cylinder has a 7 inch bore, a 4 inch rod, and a 98 inch stroke. The rod material is 17-4PH stainless steel. The original rod scrapers were teflon. The first navigation season presented a problem of a leaking seal on one unit due to contamination of the rod seal from foreign material on the rod. As a result, all cylinders were overhauled and new metallic scrapers replaced the teflon scrapers. For the past two navigation seasons, no problem with the seals has been apparent.

ADVANTAGES

Much simpler design and construction. Does not require a complicated rocker and crosshead installation. Does not require additional lock wall surface for installation. Lower initial cost.

DISADVANTAGES

Use of cylinders under water may require more maintenance. Valve position indicator system more difficult to accomplish.

RECOMMENDATIONS

Continue to monitor the cylinder function by periodic valve dewatering and inspection.

ITEM

Use of lock hydraulic machinery in a construction environment.

SITUATION

The lock hydraulic machinery was required to be operational in varying degrees throughout several navigation seasons during construction. This hostile environment (jack hammering, core drilling, and sandblasting) tended to be detrimental to the hydraulic machinery, and was no doubt responsible for the hydraulic cylinder seal leaks requiring repair.

RECOMMENDATION

In construction projects, where facilities are required to remain operational using hydraulic machinery, protect this machinery from the contamination generated.

ITEM

High Mast Lighting

SITUATION

Provide uniform, adequate lighting levels at the bottom of a deep lock chamber.

DISCUSSION

Early on it was decided that high mast lighting would be used on the site. This type of system offered a number of advantages. It reduced the number of light poles and associated wire and conduit to the standards. It elevated the light source high above the lock which eliminated tow operator glare complaints. The fixtures are easier to maintain since the entire lamp assembly can be lowered to the ground quickly. About the only concerns raised were from complaints from neighboring property about light pollution and control of the light source photometrics.

RECOMMENDATIONS

So far all comments have been favorable. No complaints have been received from neighboring properties, however, light spill will have to be more tightly controlled on future jobs.

ITEM

Application of Programmable Controller

SITUATION

Restricted space in cable and pipe trenches made it difficult to design a conventional control system cable routing scheme for Lock No. 1. Eight individual hydraulic power units with associated limit switches, lock lighting and a bubbler system had to be operable from 4 control stands and a remote master control desk in the central control station.

DISCUSSION

After considerable investigation it was decided to use an industrial programmable controller with remote input/output structures. This device is a microprocessor based system orginally designed to operate assembly line processes. The remote input/output system (I/O) interfaces pushbuttons, pilot lights, motor starters, etc. with the computer. Six (I/O) structures are located on the lock walls. These are connected to the processor via a 75 ohm coaxial cable. Control devices need only be wired to the I/O structure. Because the lock operating system exists as software in the processors memory it is not necessary to provide any interlocking wiring. With this system the entire bundle of control interwiring was eliminated. The system is much easier to use since control system changes involve only a software change or addition. This eliminates the need for extensive field rewiring. About the only negative is the lock personnels unfamiliarity with computer based systems.

RECOMMENDATIONS

With the exception of some initial start-up problems which lasted about 6 months the system has been operating very reliably. Because the system can easily handle more complex tasks, investigation should be made into expanding its use to other lock functions.

ITEM

Communication System

SITUATION

Existing communications systems at our District's Locks and Dams required a telephone, marine band radio, Corps radio, intercom and public address system be installed at each control stand and in the lock masters office.

DISCUSSION

It was decided to attempt to integrate all these features plus some new ones into an integrated communications package. There are now telephone consoles with function selection push buttons installed at the lock. The functions include 2 outside phone lines, intercom with handsfree talkback, access to lock P.A. system, site access controls, talkback speakers, 2 Corps radios and 4 marine band radio channels.

RECOMMENDATIONS

The system has been well recieved by the lock force. The only problem encountered so far is the layout of some PA speakers on the lock walls. If such a system is attempted in the future, care should be taken to find a radio system which will function well with this type of system.

ITEM

Control Houses

SITUATION

During the design phase there was much debate about the need for control houses on the upper and lower ends of the lock walls.

DISCUSSION

Elimination of the 4 control houses would have resulted in a construction cost savings. Some structure would have been required to house electrical panels, relays and remote input/output structures for the computer control system. There was some debate about the need for local control stands with a master desk in the central control station. For the past 2 years the lock has been successfully operated without resorting to the use of the local control stands. Their use would be advantageous on weekends when heavy pleasure craft use requires lock personnel to operate from the lock walls.

RECOMMENDATIONS

While some form of structure would have been necessary for electrical equipment, making fuller use of the programmable controllers capabilities would make the requirement for local control stands unnecessary.

ITEM

Cost Growth From Feasibility Through Construction.

SITUATION

The cost of the Locks and Dam No. 1 Rehabilitation Project increased from an estimate of $21,900,000 in the Study of Alternatives Design Memorandum prepared in October 1976 to $42,600,000 in August 1981 when construction was approximately 75 percent complete. The District spent considerable time reviewing and analyzing the situations and reasons for this increase.

CONCLUSIONS

The increase can be divided into eight categories. There is some overlap between categories but the titles generally represent some of the problems and uncertainties in preparing an accurate cost estimate for a difficult project at the feasibility level.

Design Revisions - Revisions to the feasibility design accounted for approximately 23 percent of the cost growth. As the detailed design was refined during the design memorandum stage and during the preparation of plans and specs., revision were required. The more detailed design also allowed more accurate estimating techniques to be used. Errors and omissions in the calculations of early quantities were also corrected.

Inflation - A major contributor to cost growth was inflation. It amounted to approximately 16 percent of the total.

Safety Improvements - The third largest growth factor of approximately 15 percent was for safety improvements. As the design proceeded and on-site investigations were made, several additional features were added to improve the safety of the project. Additional stability anchors were incorporated. The original design of the cellular sheet pile cofferdam was modified. Hydraulic improvements were added as a result of the hydraulic model study conducted by WES. Numerous smaller safety revisions were also included as the project design progressed.

Lock rehabilitation Inexperience - Approximately 13 percent of the increase is attributable to the District's inexperience in engineering a major lock and dam rehabilitation. Because of this, the early design was inadequate in some aspects. For example, cost associated with electrical features of the rehabilitation increased significantly from the original estimate. The extent of work required to convert electric equipment over a half century old to a modern, sophisticated computer-based system was simply not adequately accounted for. Other examples include a cost increase to properly account for the constricted time requirements and confined site conditions and the necessity to revise the size and scope of such features as the service building and sewer system.

Concrete Removal by Blasting - Large amounts of concrete had to be removed for lock rehabilitation, and the cost for this removal included in the original estimate was based on previous experience. However, as the detailed plans for lock rehabilitation were formulated and the emphasis was placed on minimum closure to navigation, it became apparent that the previous methods of concrete removal were not applicable. Approximately 12 percent of the cost growth is a result of additional cost for use of state-of-the-art blasting techniques for concrete removal. These costs include the need for research and development, an additional dewatering needed to test the blasting techniques, and as a modification to the construction contract to field-adapt the plans and specifications to site conditions revealed during construction. Additional expenses were incurred in the use of Title II consulting services for on-site inspection of the blasting techniques.

Fixed Time Schedule - The Minneapolis Port Authority and news media sited $20,000,000 in lost revenue for each month Lock and Dam No. 1 was closed to navigation. Congressmen wrote the District to encourage progress towards opening the lock. The District made a firm committment for opening the lock at the end of each of the dewaterings and would have received severe criticisms if the dates had not been met, regardless of the problems. For these reasons, an additional 10 percent of the original estimated cost was spent to insure the locks were open on time. In addition to two modifications for acceleration, the District specified some expensive, but expedient, construction methods.

Receipt of Bids - Approximately nine percent of the cost growth resulted from the bid opening of the Stage I contract and the operating machinery supply contract. The fall of 1979 was a good period for the construction industry and competion for work was not intense. Because of this, contractors' bids were consistently higher than during periods of minimum construction activity. Only two bids were received on the Stage I contract of this difficult project, and following award the project cost was revised upward.

General Rehabilitation - It is difficult to determine how much should be set aside for contingencies on a rehabilitation project when so much depends upon the unforeseen. At Lock and Dam No. 1, approximately 2 percent of the costs where incurred beyond the assumed contingencies because of differing site conditions.

RECOMMENDATIONS

All of the above categories occur to some extent or another in every project which a district undertakes to design and construct. At Locks and Dam No. 1, the restricted schedule for the design and construction and the complexity of rehabilitation and concrete removal caused a signigicant cost increase in the project from the initial feasibility stage. It is important that each of these areas be evaluated and considered during the initial design stages of a rehabilitation project. It should also be noted that while the cost of the Lock and Dam No. 1 Rehabilitation was approximately $43,000,000 this represents about one quarter of the cost for building a new lock and dam structure.

BIBLIOGRAPHY

Periodic Inspection Report
St. Paul District — March 1971

Study of Alternative for Rehabilitation
of Lock and Dam No. 1, Volume 1 Main Report
St. Paul District — April 1976

1976 - 1977 Winter Dewatering, Geotechnical
Investigation and Existing Condition Survey
St. Paul District — April 1977

Background Noise Level Study, Lock and
Dam No. 1
St. Paul District — May 1977

Design Memorandum for Rehabilitation
of Lock and Dam No. 1
St. Paul District — February 1978

Miter Gate Investigation
St. Paul District — June 1978

Final Environmental Impact Statement
Rehabilitation of Lock and Dam No. 1
Minneapolis, Minnesota
St. Paul District — July 1978

Filling and Emptying Valves
St. Paul District — July 1978

Design of Test Blasting Program
Woodward-Clyde Consultants — January 1979

1978 - 1979 Winter Dewatering, Geotechnical
Investigation and Existing Condition Survey
St. Paul District — 1979

Technical Report HL 79-21, "Modifications to Filling
and Emptying System of Lock No. 1, Mississippi River,
Minneapolis. Minnesota," Jackson H. Ables, Jr., U.S.
Army Engineers Waterways Experiment Station — December 1979

Development of Blast Design Criteria to be
used for Concrete Removal for the Rehabilitation
of Lock and Dam No. 1
St. Paul District — 1980

Selected Concrete Removal by Controlled Surgical
Blasting
Woodward-Clyde Consultants — August 15, 1982

(b) Reasonableness of a proposed price should be based on competitive quotations. If only one response is received, or the price variance between multiple responses reflects lack of adequate competition, a statement shall be included in the contract file setting forth the basis of the determination of fair and reasonable price. This determination may be based on a comparison of the proposed price with prices found reasonable on previous purchases, current price lists, catalogs, advertisements, similar items in a related industry, value analysis, the contracting officer's personal knowledge of the item being procured, or any other means. Written records of solicitation may be limited to notes or abstracts to show vendor or vendors contacted, prices, delivery, and any other informal historical data. If a separate form is used for documentation of price reasonableness, DD Form 1784, Small Purchase Pricing Memorandum, shall be used (see 16-813). If this form is not used, the price reasonableness statement shall be based on one or more of the criteria set forth on the form. In any case, the contracting officer should gain as much knowledge as practicable of the physical and material characteristics and intended use of the item to be purchased. When only one source is solicited, an additional notation must be made to explain the absence of competition, except for procurement of utility services available only from one source or of educational services from nonprofit institutions. Notification to unsuccessful suppliers shall be given only if requested.

(c) Occasionally an item can be obtained only from a supplier who quotes a minimum order price or quantity, which either unreasonably exceeds stated quantity requirements, or results in an unreasonable price for the quantities required. If practicable before placing the order the requiring activity should be informed in such cases of all facts regarding the quotation and requested to confirm or alter its requirement for the item or items under consideration. The file shall be documented to support the final action taken.

3-605 Blanket Purchase Agreement (BPA).

3-605.1 *General.* A blanket purchase agreement is a simplified method of filling anticipated repetitive needs for small quantities of supplies or services by establishing "charge accounts" with qualified sources of supply (see 12-302, 12-602.1 and 12-1001). Blanket purchase agreements are designed to reduce administrative costs in accomplishing small purchases by eliminating the need for issuing individual purchase documents.

3-605.2 *Limitation on Use.*

(a) A blanket purchase agreement may not be used when a call exceeds $10,000, except that BPA calls up to $25,000 may be placed by Inventory Control Points and calls for subsistence are unlimited as to dollar value.

(b) When synopsis is required under 1-1003.1, calls of $10,000 and above shall not be issued until 30 days after either publication of the synopsis or issuance of a solicitation, as appropriate.

3-605.3 *Establishment of Blanket Purchase Agreements.*

(a) *Alternate Sources.* To the extent practicable, blanket purchase agreements for items of the same type should be placed concurrently with more than one supplier. All competitive sources should be given an equal opportunity to furnish supplies or services under such agreements.

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